UNIVERSITY OF JOHANNESBURG

FACULTY OF SCIENCE

DEPARTMENT OF APPLIED PHYSICS & ENGINEERING MATHEMATICS
NATIONAL DIPLOMA IN ENVIRONMENTAL HEALTH

MODULE PHYBGT
PHYSICS I
CAMPUS **DFC**

NOVEMBER EXAMINATION

DATE 05 November 2014 **SESSION: 08:30 – 11:30**

ASSESSOR **Mr. T.G. Mathe**

INTERNAL MODERATOR **Dr. S.P. Bvumbi**

DURATION 3 HOURS **MARKS 120**

NUMBER OF PAGES: 6 PAGES, INCLUDING FORMULA SHEET

INSTRUCTIONS: **CALCULATORS ARE PERMITTED (ONLY ONE PER STUDENT)**

REQUIREMENTS: **ANSWER BOOK**

QUESTION 1 [16 marks]

1.1 Convert

1.1.1 1 $g.cm^{-3}$ to $kg.m^{-3}$ (3)

1.1.2 0.8 mm^3 to m^3 (3)

1.1.3 5.6 kN.km to N.m (3)

1.2 Fill in the blank spaces (1.2.1 – 1.2.7) in the table below: (7)

Factor of Ten	Prefix	Symbol
10^{-2}	**(1.2.1)**	c
(1.2.2)	tera-	**(1.2.3)**
10^{6}	**(1.2.4)**	M
(1.2.5)	femto-	f
(1.2.6)	giga-	**(1.2.7)**

QUESTION 2 [18 marks]

2.1 Differentiate between the following:

2.1.1 an infrasonic wave and an ultrasonic wave (2)
2.1.2 a transverse wave and a longitudinal wave (2)
2.1.3 amplitude of a wave and the pressure amplitude (2)

2.2 A bat emits sound whose frequency is 91 kHz. If the speed of sound in air is 343 $m.s^{-1}$, calculate the wavelength of the emitted sound. (3)

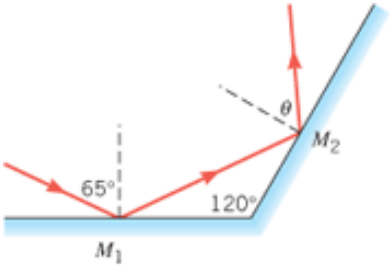
2.3 When a person wears a hearing aid, the sound intensity level increases by 30.0 dB. By what factor does the sound intensity increase? (6)

2.4 The word *sonar* is an acronym. What does it stand for? (2)

QUESTION 3 [19 marks]

3.1 State any law of reflection. (2)

3.2 Two plane mirrors are separated by 120°, as the drawing illustrates. If a ray strikes mirror M_1 at a 65° angle of incidence, at what angle θ does it leave mirror M_2? (4)



Problem 5

3.3 A convex mirror gives a magnification of ½. The mirror has a radius curvature of 30 cm. Calculate the positions of the object and the image. (6)

3.4 State any law of refraction (2)

3.5 A light ray in air is incident on a water surface at a 43^o angle of incidence. Calculate the angle of refraction. (3)

3.6 Mention two conditions that must be met for total internal reflection to occur. (2)

QUESTION 4 [19 marks]

4.1 Define a *vector quantity*. (2)

4.2 A plane flies 2000 km on a bearing of 145˚ and then 500 km on a bearing of 270˚. Use an accurate scale drawing to find the magnitude of the resultant displacement and its direction. (5)

4.3 State (in words) Newton's 2nd law of motion (2)

4.4 A new BMW car (m = 1 800 kg) accelerates from rest to 100 $km.h^{-1}$ in 10 s. Calculate the propelling force. (4)

4.5 At the final speed, what will be the momentum of the BMW in question 4.4? Express your answer in $kg.m.s^{-1}$. (2)

4.6 You are on the roof of the physics building, 46.0 m above the ground. Your Physics lecturer, who is 1.70 m tall, is walking alongside the building at a constant speed of 1.20 $m.s^{-1}$. If you wish to drop an egg on Ntate' Mathe's head, where should he be when you release the egg? Assume that the egg is in free fall. (4)

QUESTION 5 [18 marks]

5.1 Define the following terms

5.1.1 mass density (2)
5.1.2 pressure (2)

5.2 State Archimedes' principle (2)

5.3 A piece of alloy weighs 400 N in air and 339 N when in water. Calculate its volume. (6)

5.4 Calculate the pressure in alcohol (relative density = 0.8), at a depth of 30 cm. (4)

5.5 What is the difference between gauge pressure and absolute pressure? (2)

QUESTION 6 [15 marks]

6.1 Mention TWO reasons why mercury is used as a barometer liquid. (2)

6.2 Define *specific heat capacity* (2)

6.3 How much heat must be added to 3 kg of water to raise its temperature from $25^{o}C$ to $90^{o}C$? (3)

6.4 Mention THREE methods in which heat can be transferred from one object to the other. (3)

6.5 A glass bottle has a volume of 50 cm^3 at $10^{o}C$. What is its volume at $25^{o}C$? The coefficient of linear expansion of glass is 9×10^{-6} $(^{o}C)^{-1}$. (4)

6.6 **Choose the correct answer below**: The process whereby some solids change directly to gas is called

A. vaporization,
B. evaporation,
C. condensation
D. sublimation (1)

QUESTION 7 [15 marks]

7.1 State THREE conditions to be met for a charge to flow through a circuit. (3)

7.2 Define electric *current* (2)

7.3 A steady current of 15 A is maintained in a metallic conductor. What amount of charge is transferred through it in 3 minutes? (3)

7.4 State Ohm's law (2)

7.5 Resistors of 3 Ω, 4 Ω, and 5 Ω are connected in series and carry a current of 2*A*. What is the voltmeter reading across each resistor? (5)

E N D